

Historic, Archive Document

Do not assume content reflects current scientific knowledge, policies, or practices.

a 5814
R 31
33

January 1960

ARS 42-33

Automatic Sampling of

COTTON

at Gins



Agricultural Research Service



U. S. DEPARTMENT OF AGRICULTURE

CONTENTS

	Page
Introduction - - - - -	1
Commercial Equipment - - - - -	2
Early USDA-developed sampler - - - - -	6
Recent USDA-developed sampler - - - - -	8
1957 Stoneville, Mississippi, tests - - - - -	11
1958 Stoneville, Mississippi, tests - - - - -	15
1958 Mesilla Park, New Mexico, tests - - - - -	20
Summary and Conclusions - - - - -	23
References - - - - -	24

ACKNOWLEDGMENTS

Acknowledgment is made to the staffs of the ARS Cotton Ginning Research Laboratories located at Stoneville, Miss., and Mesilla Park, N. Mex., for assistance in testing a new experimental automatic sampler; and to classing offices of the Cotton Division, Agricultural Marketing Service, USDA, for classing the samples.

Prepared by

Agricultural Engineering Research Division

Agricultural Research Service

AUTOMATIC SAMPLING OF COTTON AT GINS

by C. Scott Shaw and Gerald N. Franks ^{1/}

INTRODUCTION

The conventional sampling of cotton at gins, warehouses, textile mills, and other commercial agencies is performed by cutting bales of cotton. Samplings are usually a manual operation. Each sampling is accomplished by making a cut in the bagging on two sides of the bale with a knife of special design (Fig. 1). In recent years, however, the use of motor-driven disk blades for cutting has increased.

After the cuts are made in the bale, a portion of the exposed cotton is removed from both sides (Fig. 2). Each portion is usually trimmed by hand, to roughly symmetrical proportions. This involves the removal of any outside layer of cotton that has become stained by the bagging or by penetration of dirt. The two portions are placed together to form a sample, and a coupon for bale identification is usually placed in the center of the sample or stapled to the sample wrapper.



Figure 1. "Cutting" a cotton bale in the conventional manner for sampling purposes.



Figure 2. Removing the lint cotton by "pulling" the sample from the sides of the bale after cutting.

^{1/} Cotton technologist and agricultural engineer, respectively, Agricultural Engineering Research Division, ARS, USDA.

The face of such samples is usually 4 to 6 inches wide and 12 to 16 inches long. The weight of a sample may vary from 5 to 16 ounces.

Cutting cotton bales to secure samples is a long-established practice in the United States (3).^{2/} However, this method is out of date in view of changes which have occurred in practices and facilities for harvesting, ginning, and marketing. Competition from synthetic fibers also has contributed to dissatisfaction with the hand method of sampling cotton. Synthetic textile fibers generally are handled in neat uncut packages. Moreover, mutilated bales of cotton resulting from hand sampling have been the cause of serious adverse criticism of American cotton in world markets. Each bale of cotton may be sampled several times in marketing channels, some as many as 5 or 6 times (Fig. 3 and 4).

Hand sampling continues (1959), but much research has been carried on by commercial and Federal agencies in developing improved methods and apparatus (1, 2, 4, 8).

COMMERCIAL EQUIPMENT

The recent growing interest in automatic sampling of cotton at gins by the entire industry has encouraged several manufacturers to enter this field. Three firms (1959) are known to be engaged in the manufacture and sale of such equipment.

The manufacturers have made some important improvements in automatic samplers which, in general, take the form of simplifications for trouble-free operation. The salient features and operation of the commercial designs are based on the principles employed in the original USDA-developed sampler (see next section). Commercial installations of samplers are shown in Figures 5, 6, 7, and 8.^{3/}

The use of automatic sampling equipment in gins as yet is confined mainly to the West and Southwest. The approximate location and number of gins equipped with automatic samplers is as follows: California, 56; Texas, 87; Arizona, 5; New Mexico, 3; Oklahoma, 1; and Mississippi, 1. About 100 of these installations were made during 1959. It is possible that the number of installations will increase rather rapidly in the future.

^{2/} Numbers in parantheses refer to Bibliography at the end of the report.

^{3/} Mention in this publication of commercially manufactured equipment does not imply its endorsement by the U. S. Department of Agriculture over similar products not named.



Figure 3. A photograph taken in 1959 showing the ragged appearance of cotton bales after sampling once or twice at a compress-warehouse.

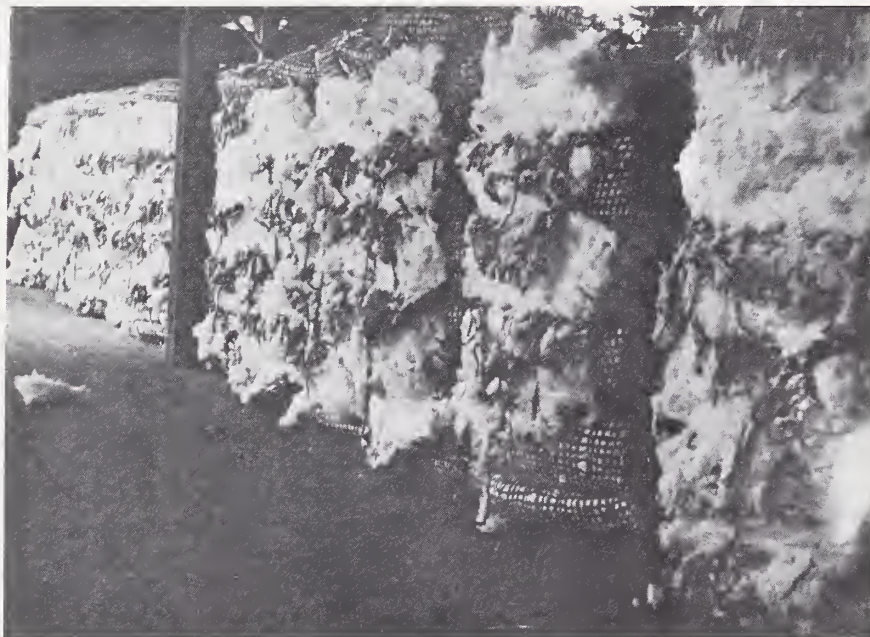


Figure 4. A typical scene in an American cotton warehouse in 1959. These bales had been sampled 4 to 5 times by the conventional, knife-cutting method.

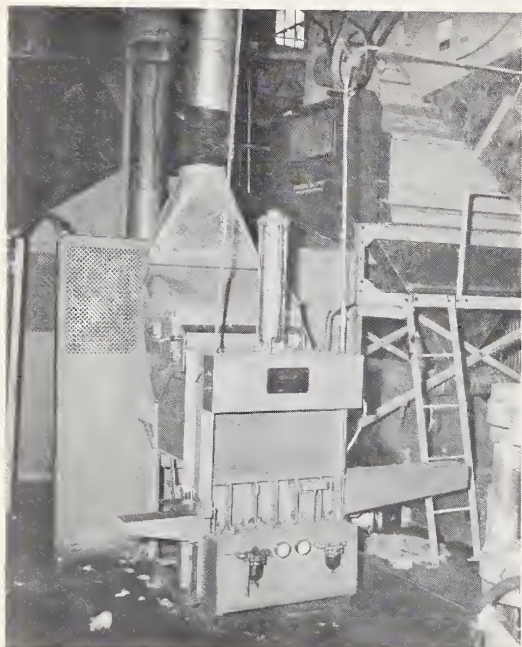


Figure 5. View of a commercial installation of an automatic cotton sample packaging unit which includes a condenser and press. (Courtesy of Lab-Quip Engineering Corp., Shreveport, La.)

Figure 6. A commercial gin installation of an automatic cotton bale sampler. (Courtesy of George F. Haddican Mfg. Co., Delano, Calif.)

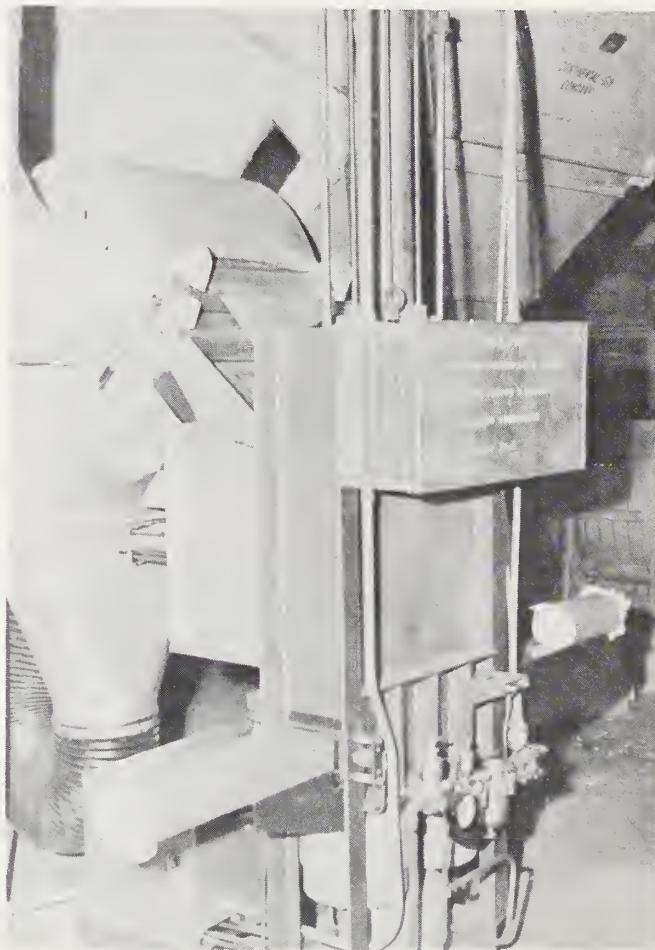
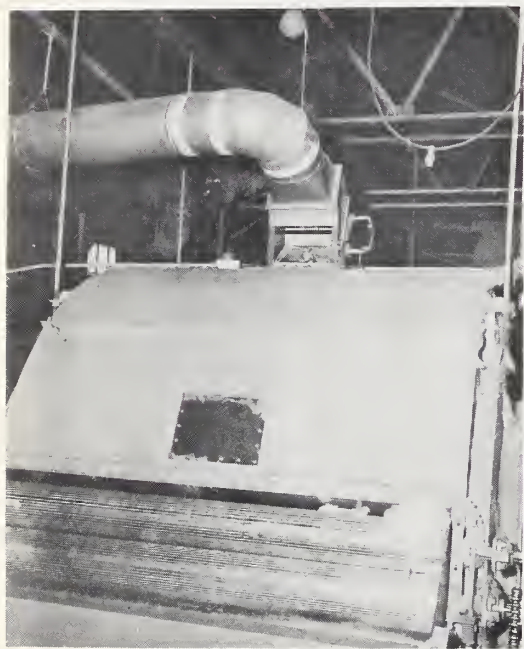


Figure 7. Illustration of location of one type of automatic sampler valve in a commercial gin. The valve operates intermittently during the ginning of a bale to extract sample segments from the battery condenser for delivery to the sample packaging unit shown in figure 9. (Courtesy of Lab-Quip Engineering Corp., Shreveport, La.)

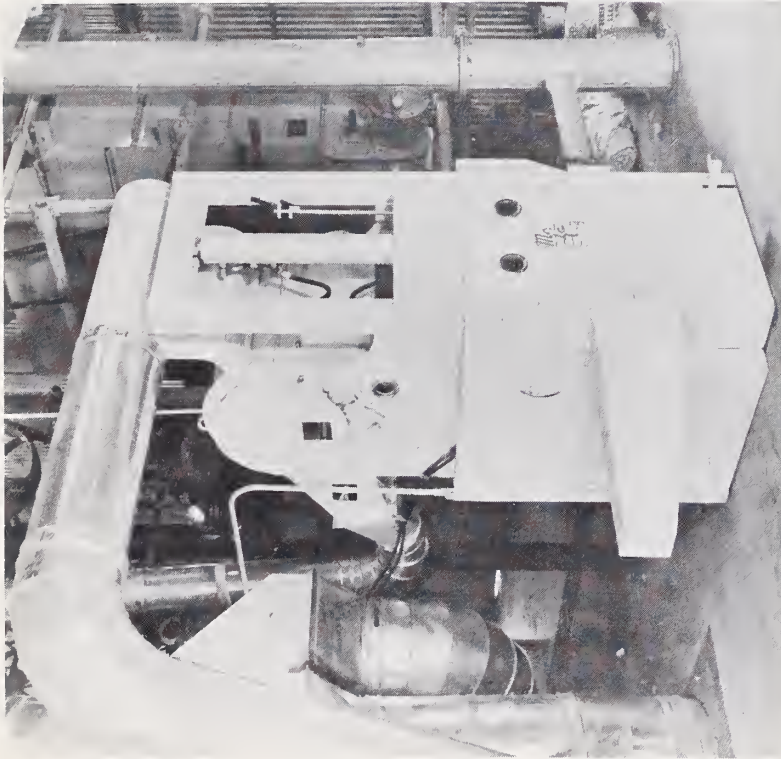
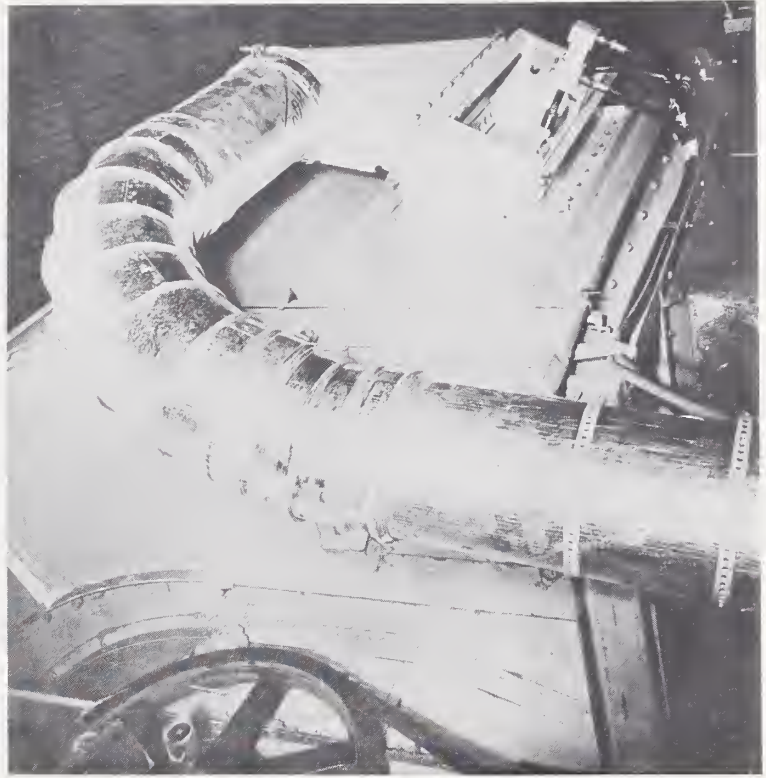


Figure 8. A commercial gin installation of an automatic cotton bale sampler. Top view shows the sampler valve at the battery condenser. Lower view shows the automatic sampler packaging unit. (Courtesy of Moss-Gordin Cleaner Co., Lubbock, Tex.)

EARLY USDA-DEVELOPED SAMPLER

Investigations in automatic sampling of cotton at gins were initiated at the U. S. Cotton Ginning Research Laboratory, Stoneville, Miss., in 1938.^{4/} In this work, efforts were made to: (1) Provide samples representative of the cotton throughout the bale; (2) reduce possibilities for human error in obtaining and identifying samples; (3) obtain samples uniform in size and appearance favorable to accurate classification; (4) identify the samples with their corresponding bales; and (5) sample without disturbing the bale coverings (Fig. 9).

Experiments with many principles and devices led to the development of a pneumatic type of automatic sampling device and automatic sample packaging unit, of the type illustrated in Figure 10. Automatic samplers based on these developments are now produced commercially.

The USDA pneumatic sampler operates in conjunction with the gin press through a system of electrical controls. The basic unit is a valve with a streamlined cross section similar to that of an airplane wing, which is placed in the gin lint flue across the mouth of a branch duct. This sampling valve swings out periodically into the stream of lint cotton and diverts part of the cotton into the branch duct, which carries it to a small cotton condenser. The condenser discharges the portion of lint, a segment of the cotton sample, into a small single-box packaging press.

The press mechanism is operated by three air cylinders. One vertical air cylinder tramps, or packs, the segments of the bale sample delivered by the condenser, another vertical air cylinder presses these segments to gin-bale density, and the third air cylinder packages the sample by sliding the pressed sample from the press horizontally into a paper sleeve. An operation of the press tramper follows each operation of the sampling valve on taking a segment of the sample and delivering the segment to the packaging press. Upon completion of ginning a bale, the tramper is locked at the bottom of its stroke. The pressing platen presses the sample, which is resting on a conveyor plate against the tramper platen with considerable force. The pressing platen then is retracted to reduce the pressure on the sample. Before the pressed sample can expand greatly, the conveyor plate and sample are thrust endwise into the paper sleeve clamped to the outside of the press.

^{4/} The initial research, the responsibility of the former Bureau of Agricultural Economics (Marketing), was conducted in cooperation with the former Bureau of Agricultural Engineering. George E. Gaus, the pioneer in this work, was assisted by engineers and other Fiber Technologists at the Cotton Ginning Research Laboratory, Stoneville, Miss.



Figure 9. Showing the neat appearance of gin low density and standard density bales which were sampled by an automatic sampler at the gin.



Figure 10. An installation for testing purposes of the USDA-developed automatic sampler and packaging unit in a commercial gin, 1952 ginning season.

Withdrawal of the conveyor plate from the sample wrapper completes the packaging operation. The packaged sample is automatically released from the packaging press (Fig. 11). This cycle is automatically controlled and synchronized, or locked in, with the gin-press operation.

RECENT USDA-DEVELOPED SAMPLER

A new type of mechanical sampler for use at gin lint slides has recently been developed at the U. S. Cotton Ginning Research Laboratory, Stoneville, Miss. (Fig. 12). The lint slide sampler is especially desirable now in view of the present trend of development and installation of battery-type lint cleaners. These new type lint cleaners are installed just ahead of the condenser and leave little space for a lint flue sampler.

The new sampler is comprised essentially of five main parts, described as follows: (1) A directional roller to guide the bat from the condenser, down and away from the sampler, and back onto the regular lint slide; (2) a revolving sampling cylinder of the same length as the lint bat width, mounted in a reciprocating frame and fitted with coarse-tooth saws for taking the subsample portions



Figure 11. Sample produced by automatic sampler. Top shows sample cut in two; middle shows whole sample; bottom shows empty sample wrapper.

of lint as it flows from the gin battery condenser; (3) an air cylinder or cam to move the sampling cylinder toward the condenser discharge to engage the bat on the sampling cycle (the cylinder is pulled back into doffing position as the direction of its rotation is reversed for uniform doffing after the sampling cycle is completed); (4) a doffing roller with rubber flaps for doffing the cotton from the sampling saw cylinder onto a conveyor belt which is situated beneath the doffing roller; and (5) a discharge chute for directing the lint cotton from the conveyor into an automatic sample press (Figs. 13 and 14).

The sampler mechanism is so designed that the number of sampling cycles or lint portions taken per bale by the sampling cylinder can be regulated. The amount of cotton taken from each bale can be increased or decreased either by the number of saws used on the cylinder or by the number of strokes or cycles per bale.

Tests were run on this device at the Stoneville Laboratory gin during the 1957 and 1958 ginning seasons. Also, an installation in a commercial gin was made and tested during the 1958 ginning season at Mesilla Park, N. Mex., by personnel from the two U. S. Cotton Ginning Research Laboratories.

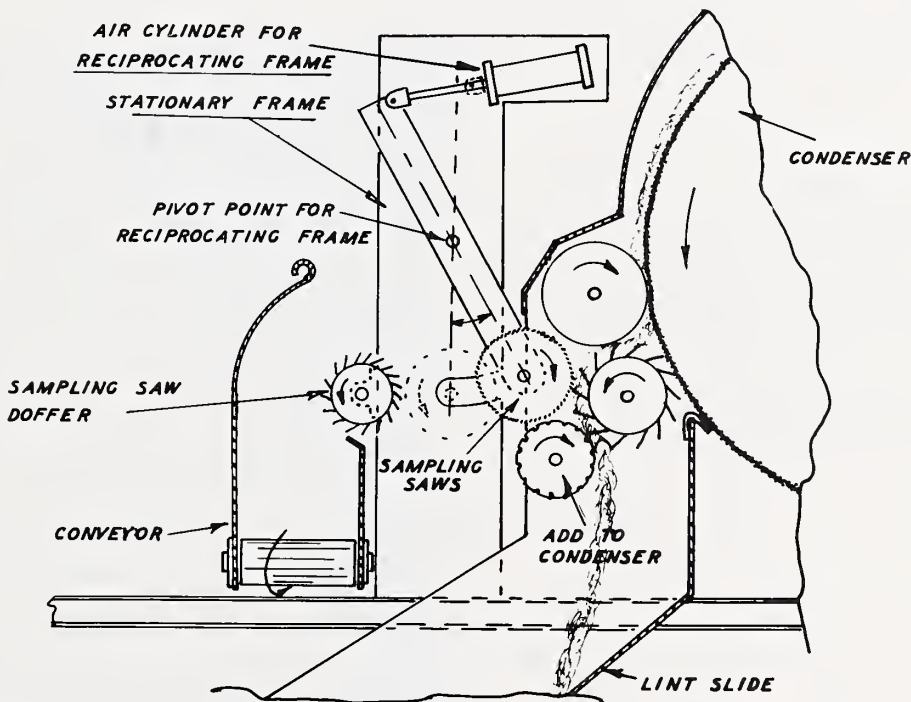


Figure 12. Diagram of the newly developed USDA mechanical sampler.

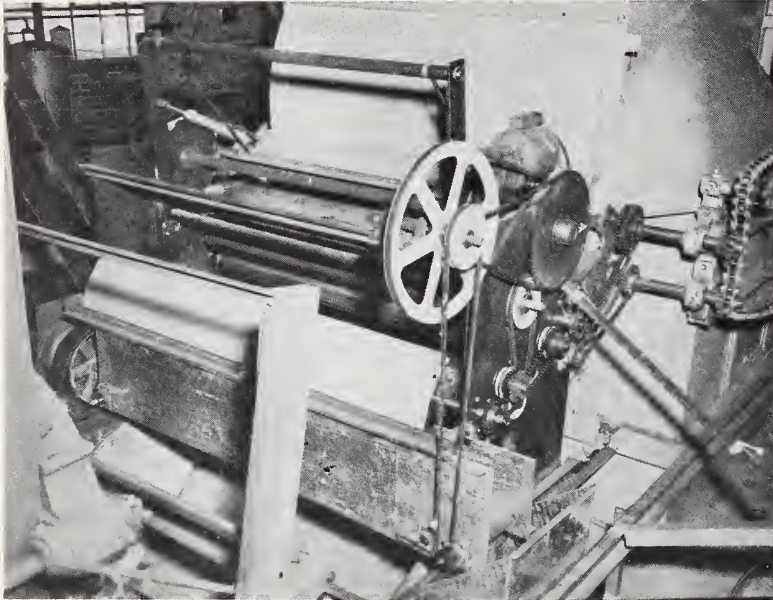
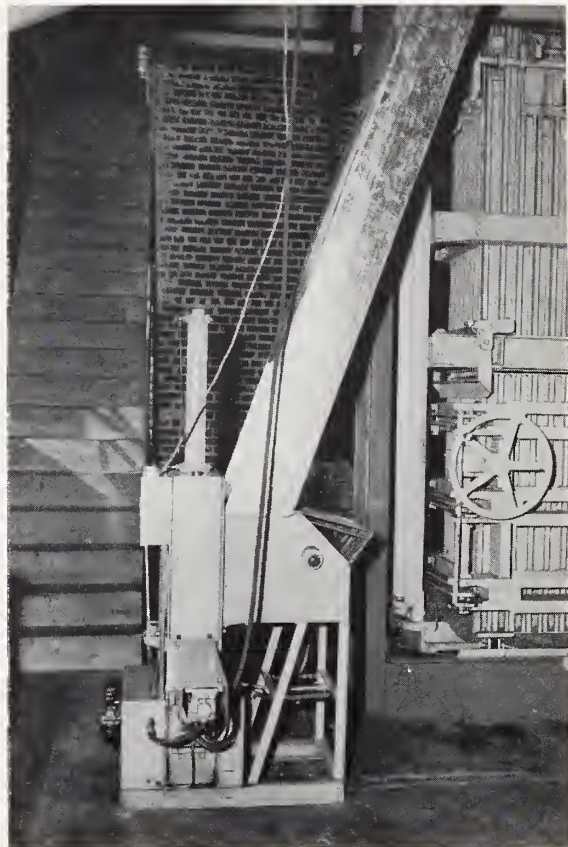


Figure 13. Discharge side of newly developed USDA mechanical sampler. The sampling saw cylinder moves in intermittently during the ginning of a bale to extract lint sample segments from the bat for delivery to any suitable sample packaging unit such as those shown in figures 6, 8, 9, and 11.

Figure 14. Lint chute for discharge of cotton from newly developed USDA mechanical sampler to the automatic packaging unit shown. This chute and packaging unit was used in sampling tests at the U. S. Cotton Ginning Laboratory, Stoneville, Miss.



1957 Stoneville, Mississippi, Tests

In the 1957 tests run with this particular sampler, 7 saws spaced equally along the cylinder proved satisfactory, providing samples averaging about one pound each in weight. The sampler made 8 to 9 cycles per bale as tested in the 3 stand (3-80) laboratory gin, depending on bale weight. The cycling mechanism in the unit tested was driven by a 1/4-hp., back-gear motor (Fig. 13). This motor, however, is omitted where air cylinders replace the cams (Fig. 12).

The samples extracted by this device may be delivered to any suitable sample packaging unit.

The sampler gave satisfactory mechanical performance in tests on 54 bales of cotton ginned in the laboratory gin during the 1957 season.

For each bale handled, 3 comparative samples were taken, one by the mechanical sampler, one by hand directly from the lint slide, and one conventional cut sample which was taken under licensed supervision at the compress warehouse.

All of these samples were classed by a Government cotton classer, and foreign matter determinations were made by the Shirley Analyzer^{5/} method. The grade index for the samples averaged 83.5 for the sampler, 83.2 for those taken by hand at the lint slide, and 82.5 for the cut samples (Table 1). The classer's staple length averaged 33.5 for those taken by the automatic sampler, 33.7 for those taken by hand at the lint slide, and 34.0 for the cut samples.

The reason for the longer staple length on the cut samples has not been determined, but differences in the representativeness of the two types of samples (taken at lint slide, and cut from the bale) might be a point for consideration. Eight of the automatic sampler samples were pressed to low density in a small-scale press and reclassified. There was essentially no difference in the staple length of these samples before and after the low density pressing.

In order to check on the possibility of error in classing, samples from 10 of the bales were classed by 2 Government classers and by a classer of a cotton cooperative association. A comparison of the average staple length and grades for these three classes is given in Table 2.

In studying the data in Table 2, it may be noted that Government classer No. 2 shows no difference in the grade or the staple length for the three types of samples, but Government classer No. 1 showed one thirty-second of an inch shorter staple length for the samples taken by the automatic sampler as compared with the cut samples. On the other hand, the same classer gave a slightly higher grade index value for the automatically drawn samples. The Cotton Association classer gave a

^{5/} See footnote 3.

Table 1. Average grade, staple length, fibrograph length, nep count, and foreign matter content test results on 3 types of corresponding samples from 54 bales of cotton^{1/} crop of 1957.

Test item	Type of sample		
	Automatic sampler	Lint slide	Cut samples
Grade:			
Index	83.5	83.2	82.5
Designation	SLM Spot	SLM Spot	SLM Spot
Staple length:			
1/32's of inch	33.5	33.7	34.0
Fibrograph length:			
Upper half mean, inches	1.08	1.09	1.08
Mean, inches	0.82	0.82	0.82
Uniformity, index	75	76	75
Neps, raw stock method:			
Number per 100 sq. in. of web .	29	32	45
Foreign matter content of lint: ^{2/}			
Percent	3.70	3.68	3.78

1/ Grade, staple length, and foreign matter content figures represent averages of 54 bales. Fibrograph and nep count figures represent averages of 24 bales.

2/ As determined by Shirley Analyzer tests. (See text footnote 3.)

longer staple length for all three types of samples with a lower difference of only 0.1 of 1/32 inch for the automatic sampler samples as compared with the cut samples, along with a slightly higher index value for the sampler. Averages of all 3 classers' designations show a slightly higher grade index value associated with the samples taken by the automatic sampler, but the grade designations for the 3 types of samples fall within the Strict Low Middling Spot minus range of 79.6 to 81.9 in index code values. These data do serve to show that the classification differences for the automatic sampler fall within the range of human error of classers, but there is a trend of slightly higher grade and lower staple length associated with the samples taken by the automatic sampler. However, the fibrograph test data did not confirm this difference in fiber length (Table 1).

In order to eliminate the possible effect of differences in moisture content on classer's staple "pull," the samples from 21 bales were

Table 2. Comparison of average grade and staple length classifications by 2 U. S. Government classers and a cotton cooperative association classer, on 3 types of corresponding samples from 10 bales of cotton, crop of 1957.

	Grade 1/		Staple length				Diff. between sampler and cut samples	
	Automatic sampler		Lint slide samples		Automatic sampler 1/32's		Cut samples	
	Index		Index		Index		Index	
U. S. Gov't Classer No. 1	81.6	81.2	80.7	33.0	34.0	34.0	34.0	40.9 -1.0
U. S. Gov't Classer No. 2	79.0	79.0	79.0	34.0	34.0	34.0	34.0	.0
Cotton Coop. Assn. Classer	80.2	79.6	79.2	34.8	34.7	34.9	34.9	11.0 - .1
Avg. all 3 classers	80.3	79.9	79.6	33.9	34.2	34.3	34.3	1.7 - .4

1/ Nearest Classification for these Average Code Values: 80 = LM Light spot; and 83 = SLM spot.

in a conditioned laboratory for 18 hours and immediately upon removal from the laboratory were taken to a Government classing office for a reclass. The comparative staple length data on the 3 sets of samples for these 21 bales are given in Table 3. These data show that the conditioning did cause the classer to "call" the staple longer, but a relative difference of longer staple length for the cut samples remained as before.

Table 3. Comparison of a classer's staple length classifications made on 3 types of corresponding samples from 21 bales of cotton before and after conditioning,^{1/} crop of 1957.

Bale No.	Staple length classification					
	Automatic sampler		Lint slide		Cut samples	
	Before	After	Before	After	Before	After
	condi- tioning 1/32's of in.	condi- tioning 1/32's of in.	condi- tioning 1/32's of in.	condi- tioning 1/32's of in.	condi- tioning 1/32's of in.	condi- tioning 1/32's of in.
158	33	33	33	33	34	35
159	33	35	33	35	33	35
160	33	35	33	34	34	35
161	33	34	33	34	34	35
163	33	35	33	35	34	35
164	33	35	33	35	34	35
165	33	33	34	35	34	35
166	33	34	33	33	34	34
167	33	34	33	33	34	34
168	33	34	33	34	34	35
169	33	35	33	34	33	35
170	33	34	33	34	33	34
171	33	33	34	34	34	35
172	33	34	33	34	34	35
173	33	35	33	34	34	33
174	33	34	33	34	33	35
175	33	33	33	34	34	34
176	33	34	33	34	33	34
177	33	35	33	35	34	35
178	33	35	34	35	34	36
179	33	34	33	33	34	34
Avg. All	33.0	34.2	33.1	34.1	33.8	34.7

^{1/} The conditioned samples were kept in an airconditioned laboratory for 18 hours, at a temperature of 75° F. and at a relative humidity of 60 percent, before classification.

As a further check on staple length differences, the cotton from six of the samples taken by the automatic sampler and lint slide were passed through compression rollers to see if this pressure would change the cotton sufficiently to affect the classer's staple designation. The pressing operation, however, did not affect the staple length results.

To further investigate pressure effects, nine bales were sampled in which the air pressure to the ram of the automatic sampler press was increased from 125 to 150 p.s.i. Under these conditions only two of the samples taken by the automatic sampler classed shorter in staple length than the cut samples. These slight differences in staple length as determined by the classer may justifiably be attributed to the effect of sampling technique or classer's opinion. All samples taken by automatic equipment would be uniform with respect to sampling technique.

The several segments of cotton taken from each bale by the automatic sampler certainly provide a more representative cross-section sample than does the conventional, cut sample. This is illustrated by a particular instance in which the cotton classer graded a bale as two-sided and reduced it in the conventional manner--in this instance from Middling to the "lower side" of SLM Light Spot. This bale was a Middling bale, ginned immediately following a SLM Light Spot bale. A very thin, negligible layer of this lower grade lint cotton from the preceding bale was delivered into the press at the start of the Middling bale. When the bale was cut in the conventional manner from the 2 sides, this thin layer of low-grade cotton was conspicuous in the sample; but in the 9-segment representative sample taken by the automatic sampler this negligible thin portion of lower grade cotton was not conspicuous, and the classer graded the bale Middling, which was its true grade.

1958 Stoneville, Mississippi, Tests

In 1958, 30 bales were subjected to sampling by the lint slide sampler in the Stoneville Laboratory gin. In handling 10 of these bales, alternate comparative samples were taken as follows: On 5 of the 10 bales, a sample was taken by the lint slide sampler and delivered down the chute to accumulate in the packaging unit press box during the ginning of the bale; then it was removed and rolled by hand into a sample with an identification ticket inside but without a paper wrapper. A sample from each of the corresponding five bales likewise was taken by the lint slide sampler, but these samples were pressed in the automatic sample packaging unit. Corresponding conventional cut samples were also taken for comparison.

This test was made to ascertain whether there would be any significant difference between pressed and unpressed samples obtained by the lint slide sampler. The unpressed samples averaged 95.6 (SLM+) in

grade code value and 32.6 (1/32's of an inch) in staple length whereas the pressed samples averaged 95.2 (SLM+) in grade code value and 32.6 (1/32's of an inch) in staple length. From a trade class standpoint, there was, therefore, no difference in the classification of the pressed and unpressed samples. It is interesting, however, to note that the corresponding conventional cut samples averaged a slightly lower 93.6 (SLM) in grade code value and 32.4 (1/32's of an inch) in staple length. (The latter is contrary to the 1957 average.) The nep count for the unpressed, automatic, lint slide samples averaged 38; both the pressed automatic, lint slide samples and the corresponding conventional cut samples averaged 42 in nep count.

The fibrograph upper half mean length averaged 1.03 inches for the unpressed, automatic, lint slide samples; 1.02 inches for the pressed samples; and 1.00 for the corresponding conventional cut samples. The foreign matter content of the 3 types of samples (by the Shirley Analyzer method) averaged 2.55 percent for the unpressed, automatic, lint slide samples; 2.98 percent for the pressed, automatic, lint slide samples; and 3.06 for the conventional cut samples (Table 4.)

For each of the other 20 bales tested at the Stoneville Laboratory in 1958, 3 comparative samples were taken. One sample was taken by the mechanical sampler followed by pressing in the automatic packaging unit; another was taken by hand directly from the lint slide; and a conventional cut sample was taken under licensed supervision at the compress warehouse.

These samples were classed by a Government cotton classer; nep content and fibrograph length tests were made and foreign matter determinations were made by the Shirley Analyzer method.

The grade code index values for the samples which were automatically taken and pressed averaged 94.8 (SLM); the samples taken by hand from the lint slide averaged 94.9 (SLM); and the conventional cut samples averaged 94.6 (SLM). The classer's staple length (1/32's of an inch) for the automatically taken samples, hand-taken lint slide samples, and conventional cut samples averaged 32.7, 33.1, and 32.6, respectively. The slightly lower average staple length of the cut samples does not correspond with the results of 1957, where the cut samples were slightly higher in staple length than the uncut ones. As was previously suggested, the differences between the cut samples and those taken at lint slide might be attributed to difference in the representativeness of the samples.

Table 4. Average grade, staple length, fibrograph length, nep count, and foreign matter content test results on 3 types of corresponding samples from 5 bales of cotton, crop of 1958.

Test Item	Type of sample		
	Automatic sampler, pressed	Automatic sampler, not pressed	Cut samples
Grade: <u>1/</u>			
Index	95.2	95.6	93.6
Designation	SLM†	SLM†	SLM
Staple length:			
1/32's of inch	32.6	32.8	32.4
Fibrograph length:			
Upper half mean, inches . .	1.02	1.03	1.00
Mean, inches	0.77	0.79	0.76
Uniformity, index	76	76	76
Neps, raw stock method:			
Number per 100 sq. in. of web	38	42	42
Foreign matter content of lint: <u>2/</u>			
Percent	2.98	2.55	3.06

1/ 94 = SLM; 97 = SLM†.

2/ As determined by Shirley Analyzer tests. (See text footnote 3.)

The foreign matter content of the 3 types of lint samples (by the Shirley Analyzer method) averaged 2.84 for the samples taken automatically, 2.51 for the lint slide samples taken by hand, and 3.14 for the cut samples (Table 5).

The fibrograph upper half mean length for the samples taken automatically, the lint slide samples, and the cut samples averaged 1.02, 1.04, and 1.03 inches, respectively (Table 6). These results are within the range of standard error.

Table 5. Comparison of grade and staple length classifications and foreign matter content test results on 3 types of corresponding samples from 20 bales of cotton, crop of 1958.

Bale No.	Grade classification ^{1/}			Staple length classification			Foreign matter content of lint ^{2/}		
	Automatic	Lint	Cut	Automatic	Lint	Cut	Automatic	Lint	Cut
	sampler	slide	samples	sampler	slide	samples	sampler	slide	samples
	Index	Index	Index	of inch	of inch	1/32's	Percent	Percent	Percent
				1/32's	1/32's	1/32's			
114	94	94	96	33	33	33	3.01	1.97	3.44
117	96	96	94	33	33	33	3.08	2.64	2.60
119	94	94	88	33	33	33	3.74	2.37	3.40
121	96	96	94	32	32	32	1.78	2.20	3.15
123	94	96	96	32	33	32	2.25	2.21	1.90
124	94	94	96	33	33	32	3.31	2.85	2.63
126	94	88	94	33	34	34	3.42	3.60	3.31
130	94	96	94	32	34	32	2.87	2.76	3.47
131	94	94	94	33	32	32	2.41	2.14	2.47
132	96	94	96	32	32	32	2.70	1.96	3.54
133	94	100	96	32	32	32	1.64	2.36	2.64
134	96	96	96	32	33	32	2.92	2.62	3.01
137	94	94	94	33	34	34	2.77	2.67	2.90
138	94	96	94	33	33	32	3.45	2.92	3.96
139	94	94	94	33	34	33	3.00	2.26	4.25
140	94	94	94	33	34	33	2.75	2.93	3.78
141	96	96	96	33	33	32	2.54	1.94	3.36
142	96	96	96	33	34	33	2.03	2.77	3.01
143	96	96	94	33	33	33	3.42	2.90	3.49
144	96	94	96	33	33	33	3.61	2.06	2.60
Avg. All	94.8	94.9	94.6	32.7	33.1	32.6	2.84	2.51	3.14

^{1/} 88 = LM*; 94 = SLM; 96 = SLM*; 100 = M.

^{2/} As determined by Shirley Analyzer tests. (See text footnote 3.)

Table 6. Comparison of nep count and fibrograph length results on 3 types of corresponding samples from 20 bales of cotton, crop of 1958.

Bale No.	Automatic sampler			Lint slide			Cut samples		
	Fibrograph length			Fibrograph length			Fibrograph length		
	Upper half			Upper half			Upper half		
	Neps	mean	Mean	Neps	mean	Mean	Neps	mean	Mean
	Per 100			Per 100			Per 100		
	sq. in.			sq. in.			sq. in.		
	of web	Inches	Inch	of web	Inches	Inch	of web	Inches	Inch
114	50	1.03	0.75	61	1.06	0.76	38	1.06	0.78
117	42	1.00	.75	46	1.02	.78	48	1.03	.77
119	40	1.03	.77	52	1.03	.77	51	1.04	.78
121	25	.96	.75	32	.98	.76	26	.98	.77
123	38	.96	.75	35	1.05	.81	39	1.05	.82
124	33	1.07	.82	41	1.08	.81	32	.98	.77
126	30	1.08	.80	37	1.11	.84	37	1.09	.84
130	57	1.02	.81	59	1.06	.82	23	1.01	.79
131	23	.99	.81	27	1.00	.80	29	1.01	.80
132	44	.97	.76	36	.97	.76	29	.98	.76
133	37	.96	.78	28	.97	.77	45	.94	.72
134	29	.97	.78	35	.98	.79	35	.98	.78
137	38	1.09	.84	37	1.12	.84	39	1.10	.84
138	43	1.08	.80	43	1.08	.82	57	1.08	.81
139	46	1.06	.78	43	1.09	.82	45	1.10	.82
140	45	1.07	.82	42	1.11	.84	41	1.08	.80
141	44	1.04	.78	47	1.06	.78	44	1.05	.79
142	43	1.04	.75	45	1.04	.76	52	1.06	.80
143	59	1.02	.76	59	1.02	.76	49	1.01	.75
144	48	1.02	.75	53	1.04	.79	34	1.02	.75
Avg.									
All	40.7	1.02	0.78	42.9	1.04	0.79	40	1.03	0.79



Figure 15. Completed sample ejected from a commercial sample packaging unit. The newly developed USDA mechanical sampler was used in conjunction with this packaging unit in a commercial gin at Mesilla Park, N. Mex.

Nep count differences for the three types of samples were insignificant. The count for the samples taken automatically, the lint slide samples, and the cut samples averaged 40.7, 42.9, and 40.0, respectively (Table 6).

1958 Mesilla Park, New Mexico, Tests^{6/}

During the 1958-59 ginning season an installation of the lint slide sampler was made and tested in a 5-stand, 80-saw commercial gin at Mesilla Park, New Mexico by the U. S. Cotton Ginning Research Laboratories. This gin had a short lint slide hookup and therefore presented an ideal situation for installing and testing the sampler (Figure 15) under extremely difficult conditions. Sufficient necessary experiments and adjustments were made so as to adapt the sampler for use in this gin.

In adapting the lint slide sampler for use with the short lint slide it was necessary to make adjustments for handling the fast moving, dry, fluffy cotton. This required experimentation to determine the proper

^{6/} The information and test result data given here concerning these tests were taken from an office report prepared by David M. Alberson Agricultural Engineer, Cotton Ginning Research Laboratory, ARS, USDA, Mesilla Park, N. Mex.

length of stroke of the sampling cylinder and the number of saws to use on the sampling cylinder, along with regulation of the timing intervals involving the in-and-out movement of the cylinder to contact the lint cotton bat.

The grade and staple results on the samples taken automatically during this experimental period and the corresponding cut samples were similar to the results obtained in the tests at Stoneville (Table 7 and 8).

Immediately following these experimental adjustments, the sampler was used continuously in the gin for 2 days while 204 bales were sampled automatically. Paired samples, automatically taken ones and cut ones, were taken for analysis on every twelfth bale. The average grade, staple length, and fiber test results are shown in Table 9.

Table 7. Comparison of average grade and staple length test results on corresponding automatically taken samples and cut samples in tests at a commercial cotton gin, Mesilla Park, N. Mex., crop of 1958.

Date samples taken	Samples providing averages	Grade ^{1/}		Staple length	
		Automatic sampler	Cut samples	Automatic sampler	Cut samples
				1/32's of inch	1/32's of inch
	Number	Index	Index		
Sept. 23 & 24	25	99.8	100.3	37.0	37.1
Oct. 1	15	94.8	93.8	36.7	36.8
Oct. 10 & 13	27	97.0	97.1	36.6	36.6
Oct. 28	11	97.1	99.1	36.1	36.2
Oct. 31	15	96.0	95.9	35.9	36.0

^{1/} 94 = SLM; 97 = SLM+; and 100 = M.

Table 8. Comparison of average nep count, fibrograph length, and color measurement test results on corresponding automatically taken samples and cut samples in tests involving 10 bales of cotton at a commercial cotton gin, Mesilla Park, N. Mex., crop of 1958.

Test Item	Type of sample	
	Automatic sampler	Cut samples
Neps, raw stock method:		
Number per 100 sq. in. of web	9.2	10.7
Fibrograph length:		
Upper half mean, inches	1.23	1.23
Mean, inches	.98	.98
Uniformity, index	80	80
Color measurements:		
Rd (reflectance)	76.8	76.7
fb (yellowness)	8.1	8.1

Table 9. Comparison of average grade, staple length, fibrograph length, and nep count test results on corresponding automatically taken samples and cut samples in tests involving 17 bales of cotton (every 12th bale in a 2-day run) at a commercial cotton gin, Mesilla Park, N. Mex., crop of 1958.

Test item	Type of sample	
	Automatic sampler	Cut samples
Grade: ^{1/}		
Index	96.9	97.3
Staple length:		
1/32's of inch	35.0	35.4
Fibrograph length:		
Upper half mean, index	1.18	1.18
Mean, inches	.95	.94
Uniformity, index	80	80
Neps, raw stock method:		
Number per 100 sq. in. of web	11.7	12.7

^{1/} 97 = SLM+; 100 = M.

SUMMARY AND CONCLUSIONS

The conventional hand cutting into the sides of cotton bales for sampling purposes has several serious shortcomings. Among the major faults are: (1) Samples cut from the surfaces of a bale frequently fail to provide a representative sample; (2) mutilation of bale coverings detract from appearance of bale and increase fire hazard; (3) risk of human error in obtaining and handling samples is great; (4) samples pulled from the bale by hand lack uniformity in size, appearance, and smoothness; and (5) the easy hand sampling operation tends to result in unnecessary sampling and removal of considerable cotton.

The U. S. Department of Agriculture has for a long time recognized the faults of the conventional hand method of sampling bales of cotton and in 1938 initiated research in this field at the U. S. Cotton Ginning Research Laboratory at Stoneville, Miss. The objective of the research was the development of apparatus which would overcome the major objections of the hand method. After experiments with many principles and devices, this work led to the development of a pneumatic type of automatic sampler and an automatic sample packaging unit.

Despite the merits of mechanical sampling, difficulties have been encountered in overcoming the long-established hand method. Recently, however, interest has grown and at least three firms manufacture such equipment.

The manufacturers have made some important improvements in automatic samplers, such as simplification and precision production of parts for trouble-free operation. In general, however, the salient features and operation of the commercial designs are based upon the principles employed in the original USDA-developed sampler.

The use of automatic sampling equipment in gins currently is confined mainly to California and the Southwest. The location and number of gins equipped with automatic samplers, May 1959, is as follows: California, 56; Texas, 87; Arizona, 5; New Mexico, 3; Oklahoma, 1; and Mississippi, 1. Approximately 100 of these installations were made in 1959. The number of installations may increase rather rapidly in the future.

A new type mechanical sampler for use at gin lint slides has recently been developed at the U. S. Cotton Ginning Research Laboratory, Stoneville, Miss. Saws mounted on a shaft extend across the width of the lint slide for engaging lint for a sample. The mechanism is so designed that the number of sampling cycles and lint portions taken per bale by the sampling cylinder can be regulated, and the amount of cotton taken with each stroke or cycle of the sampling cylinder can be increased or decreased by the number of saws used on the cylinder.

A lint slide sampler is especially desirable at this time owing to the present trend of development of battery type lint cleaners, which are being installed ahead of the condenser. Such a position of installation complicates the installation of lint flue samplers. Laboratory and commercial gin tests with the new sampler, however, provide encouraging results as to mechanical operation. The tests also show that samples obtained are representative of cotton in the bales.

BIBLIOGRAPHY

- (1) Cooper, Maurice R.
1955. Automatic Lint Cotton Sampler. U. S. Dept. Agr. Agr. Mktg. Serv., Marketing Activities 18(11): 14-16.
- (2) Gaus, George E., and Larrison, John F.
1951. Automatic Mechanical Equipment for Sampling Cotton Bales During Ginning. U. S. Dept. Agr., Prod. & Mktg. Admin. (Processed.)
- (3) Martin, S. W., and Cleaves, F.
1936. Sampling American Cotton. U. S. Dept. Agr., Bur. Agr. Econ. (Processed.)
- (4) Soxman, R. C., and Gaus, George E.
1950. The Sampling of Cotton Bales as Related to Marketing. U. S. Dept. Agr., Prod. & Mktg. Admin. (Nov.). (Processed.)
- (5) United States Production and Marketing Administration.
1945. Automatic Cotton-Bale Sampler. U. S. Dept. Agr. Agr. Mktg. Serv., Marketing Activities 8 (10): 14-15. (Processed.)
- (6)

1946. The Place of Cotton as a Textile Material. U. S. Dept. Agr., Production & Mktg. Admin. (Oct.) (Processed.) Ref. p. 7.
- (7)

1948. Recent Technological and Economic Developments in Cotton Ginning and Marketing. U. S. Dept. Agr., Prod. & Mktg. Admin. (Feb.) (Processed.) Ref. p. 8.
- (8) Wright, J. W.
1938. Marketing Practices in Producers' Local Markets. U. S. Dept. Agr., Bur. Agr. Econ. (May). (Processed.)
- (9)

1938. Some Problems in Cotton Marketing. U. S. Dept. Agr., Bur. Agr. Econ. (Dec.) (Processed.)

(10)

1944. Some Possibilities for Reducing Costs of Distribution of Cotton. U. S. Dept. Agr., War Food Admin., Cotton and Fiber Branch. (Processed.)

(11)

Gerdes, F. L., and Bennett, C. A.
1945. The Packaging of American Cotton and Methods for Improvement. U. S. Dept. Agr. Cir. 736, 62 pp. Refs. to sampling, pp. 20, 25, 58, and 62.

United States Department of Agriculture

Public Patents on Mechanical Cotton Samplers

Patent No. 1,428,978, Sept. 12, 1922.
Patent No. 2,144,306, Jan. 17, 1939.
Patent No. 2,156,893, May 2, 1939.
Patent No. 2,156,894, May 2, 1939.
Patent No. 2,166,811, July 18, 1939.
Patent No. 2,173,071, Sept. 12, 1939.
Patent No. 2,320,544, June 1, 1943.
Patent No. 2,812,555, Nov. 12, 1957.
Patent No. 2,859,485, Nov. 11, 1958.

5529

Ms Sweet

120